

# SAFE DRIVE AI

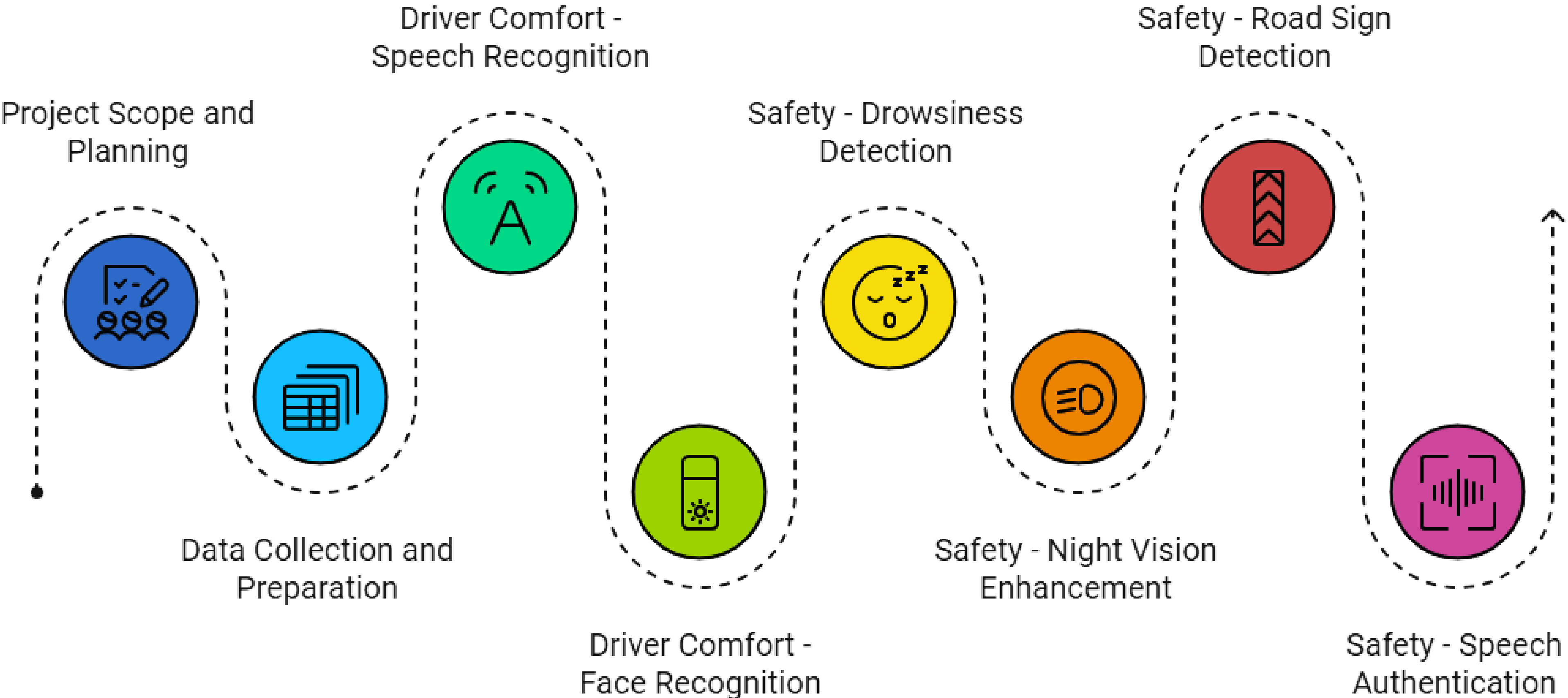
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# PROBLEM STATEMENT: REVOLUTIONIZING DRIVING WITH AI

Our project tackles the need for enhanced safety, luxury, and automation in modern vehicles, leveraging intelligent systems to transform the driving experience. This vision aligns with Qualcomm's leadership in automotive AI through their Snapdragon Ride™ and Snapdragon Elite™ platforms, paving the way for smarter, connected cars.

- Security Vulnerabilities
- Lack of Personalization
- Distracted Driving
- Nighttime Visibility Issues
- Driver Fatigue
- Traffic and Obstacle Navigation
- Fragmented and Inefficient Existing Solutions

# PROJECT ROADMAP



# MODELS PRESENTED

Driver Speech  
Authentication

Face Recognition

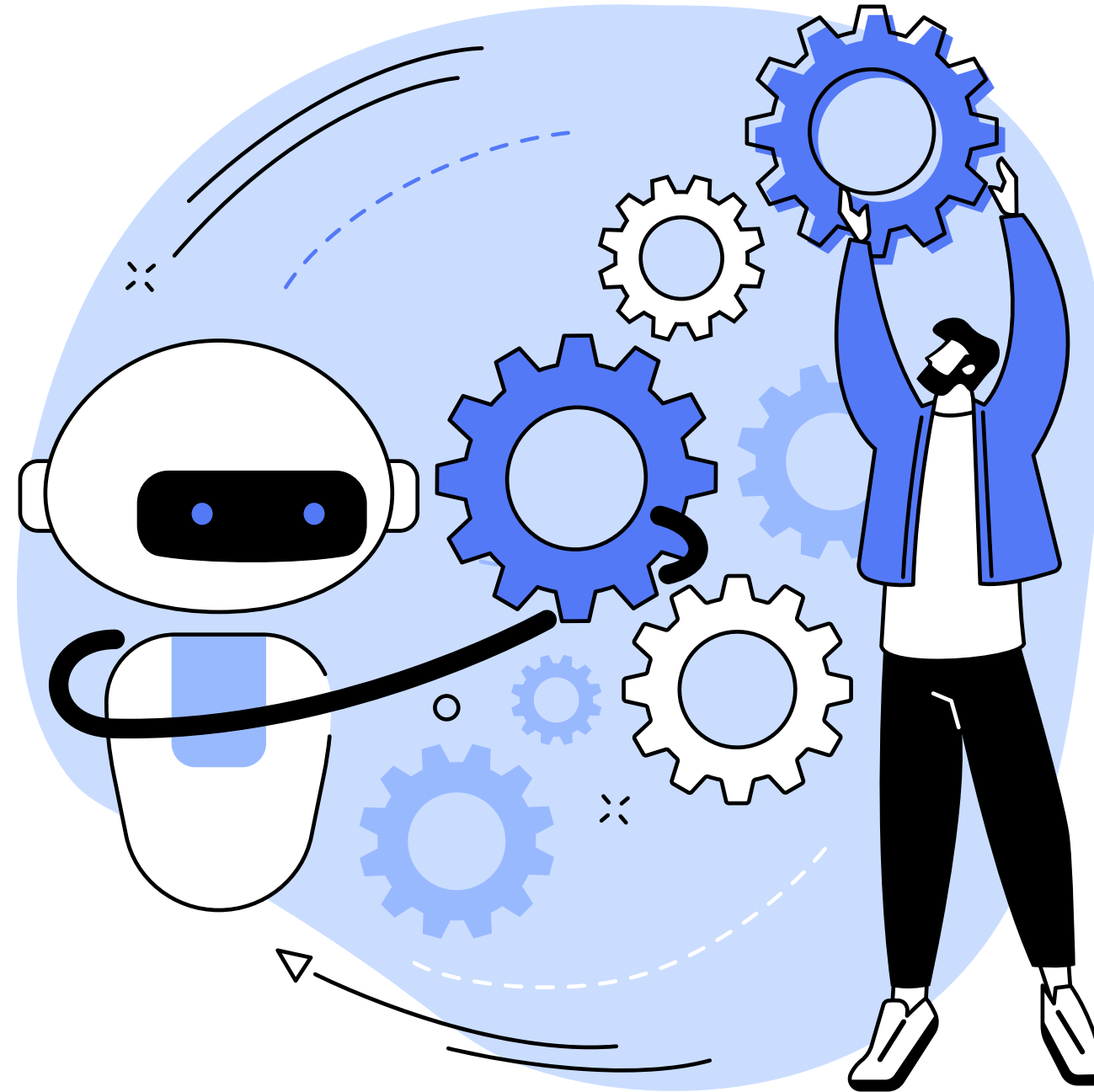
Drowsiness  
Detection

Speech  
Recognition

Object Detection  
and Navigation

Low Light Vision

Road Sign  
Recognition



# VOICE-ACTIVATED INTELLIGENT COMMAND SYSTEM

Accuracy: 92.5%

- **Seamless Integration:** Interact with your car using natural language commands like, “Navigate to home” or “Play my playlist.”
- **Advanced Understanding:** Processes real-time audio with Word2Vec to accurately interpret context and intent.
- **Enhanced Focus on Safety:** Reduces distractions, ensuring you keep your eyes on the road while the system executes your commands.
- **Quick Response Time:** Commands are processed and executed instantly, offering a truly hands-free experience.



# VOICE AUTHENTICATION

## Feature Extraction:

- Uses MFCC to extract unique audio features.

## Model:

- Siamese network with ResNet-18 backbone and attention mechanism for one-shot learning.

## Workflow:

- Enrollment: Store speaker's audio embedding.
- Verification: Compare new audio embedding using Euclidean distance.

## Voice Authentication:

- Biometric security using unique voice characteristics for secure & convenient access.

Accuracy: 82%

## Voice Authentication Process

### Access Decision

Access is granted or denied based on the comparison.

### Feature Comparison

Extracted features are compared to a stored voiceprint.

### One-Shot Learning

Voice features are processed using a neural network.

### Feature Extraction

Sound waves are analyzed to extract voice features.

### User Input

A user speaks a predefined phrase into a microphone.

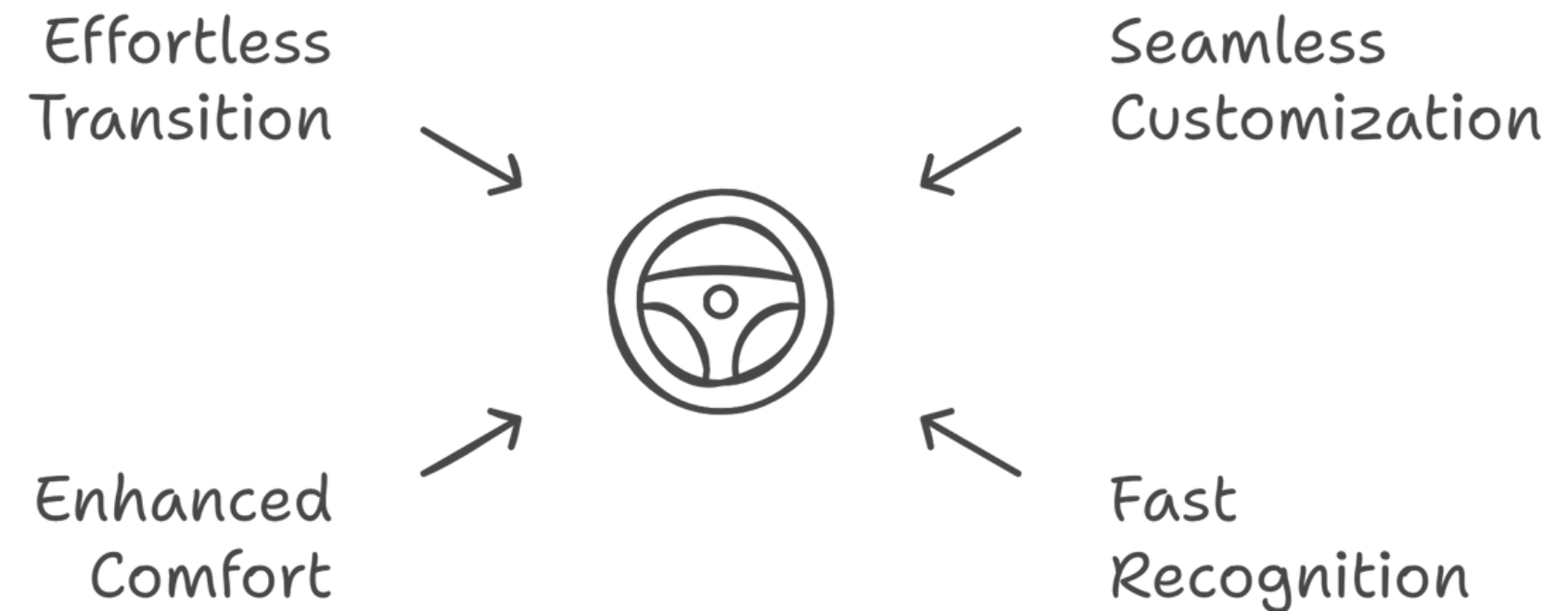


# INTELLIGENT FACIAL RECOGNITION

Accuracy: 96%

- **Seamless Customization:** Automatically adjusts seat position, music preferences, and climate settings based on your unique profile.
- **Fast and Reliable Recognition:** Powered by KNN-based facial recognition for quick and efficient profile matching.
- **Enhanced Comfort:** Saves your preferences to deliver a tailored driving experience every time.
- **Effortless Transition:** Your car adapts to you the moment you step inside.

## Intelligent Facial Recognition in Vehicles





# OBJECT DETECTION AND NAVIGATION

**Accuracy: 89.5%**

## 1. Objective:

- Ensures real-time safety by detecting objects, pedestrians, and traffic signs using advanced YOLOv5 object detection.

## 2. Technical Implementation:

- Utilizes YOLOv5 for detecting relevant objects such as vehicles and pedestrians with high accuracy.
- Navigation logic is based on varying pixel values to analyze object positions and calculate direction.

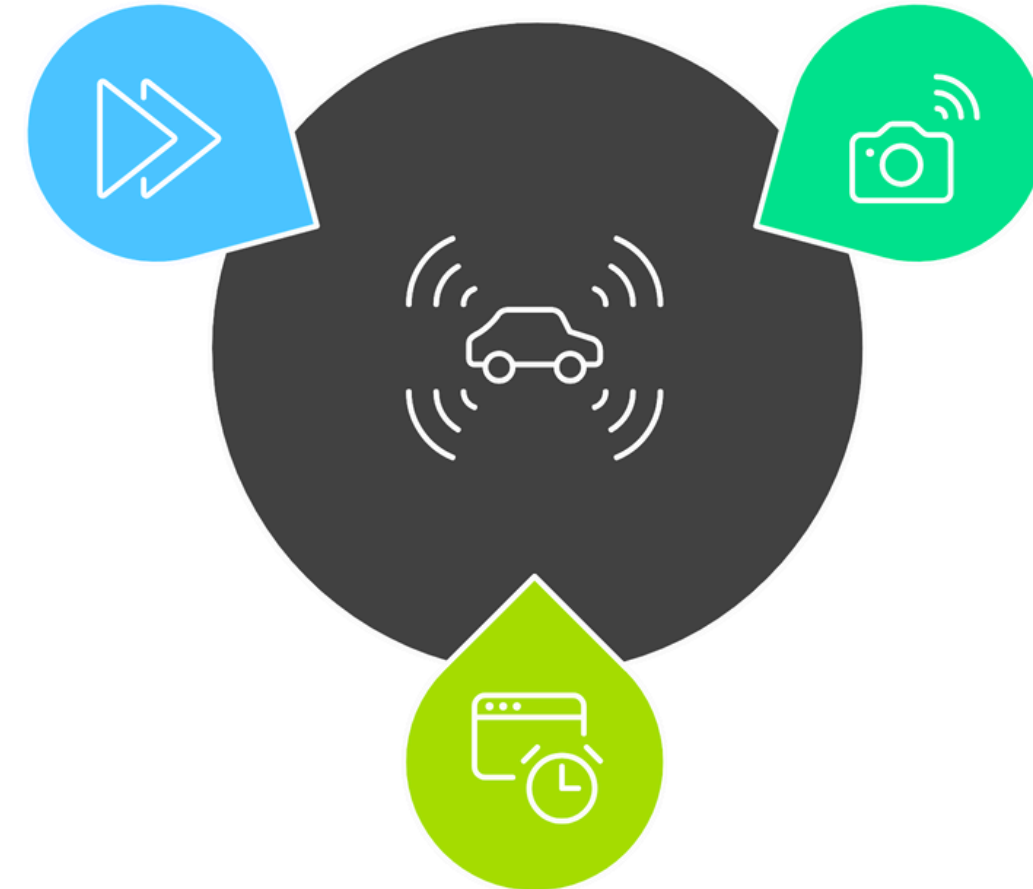
## 3. Workflow:

- Object Detection: Identifies objects and their locations with bounding boxes.

## Components of Safe Navigation System

### Navigation Commands

Provides clear instructions for safe navigation



### YOLOv5

Detects objects in real-time for safety

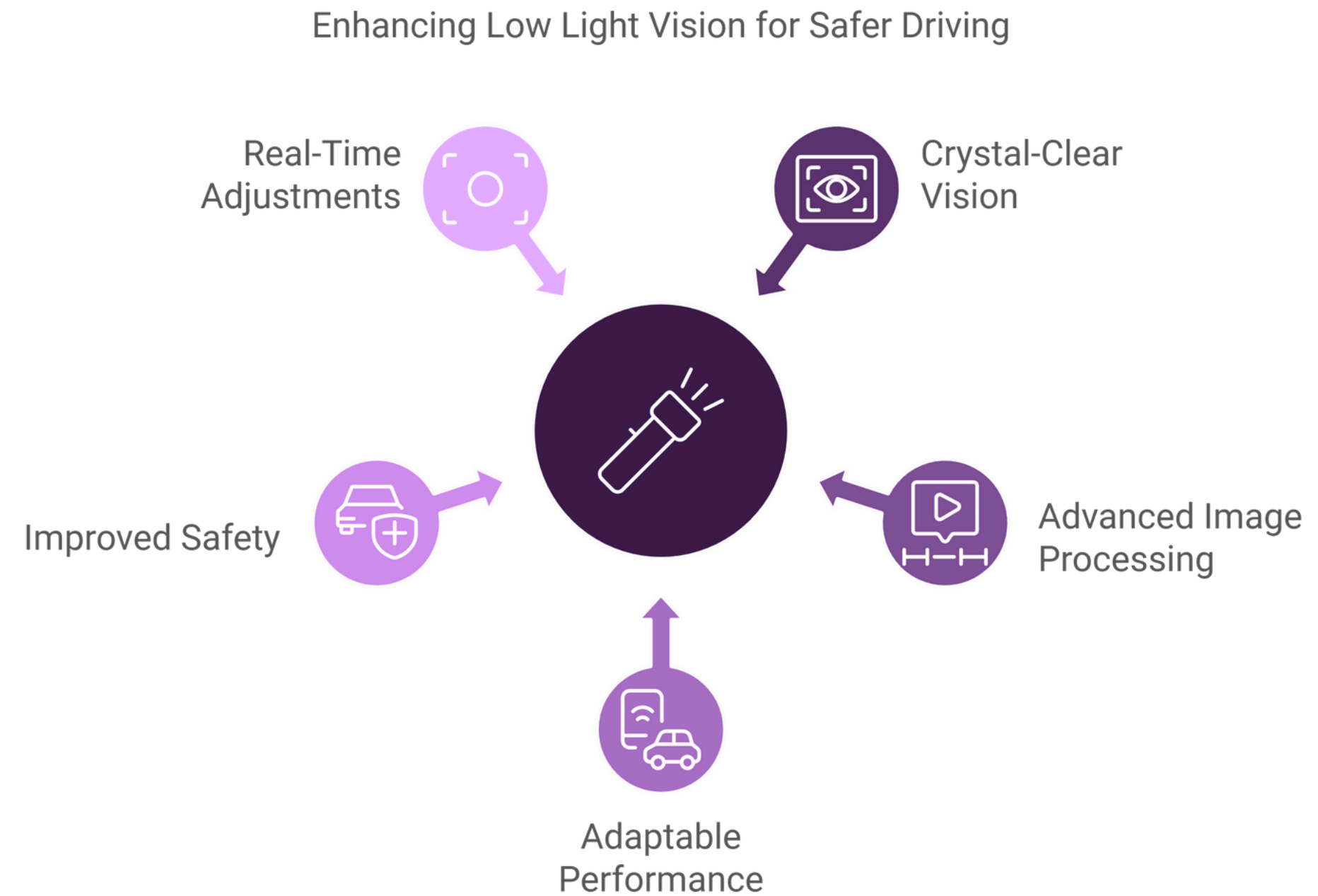
### Real-Time Processing

Processes video streams for immediate response



# LOW LIGHT VISION

- **Crystal-Clear Vision:** Enhances road visibility by removing fog, rain, and glare for a safer driving experience.
- **Advanced Image Processing:** Utilizes real-time image dehazing algorithms to boost contrast and clarity.
- **Adaptable Performance:** Optimized for challenging conditions like low light, heavy fog, and nighttime driving.
- **Improved Safety:** Identifies obstacles and enhances driver confidence during adverse weather.
- **Real-Time Adjustments:** Continuously processes video feed to ensure the clearest possible view.



# DROWSINESS DETECTION

Accuracy: 90%

- **Fatigue Monitoring:** Tracks eye movement, head position, and yawning to detect drowsiness.
- **Real-Time Alerts:** Issues audio and visual alerts when fatigue is detected.
- **Proactive Response:** Encourages the driver to take a break or offers energizing music and climate adjustments.
- **Improved Safety:** Reduces the risk of accidents caused by driver fatigue or inattention.

## Drowsiness Detection Outcomes

### Improved Safety

Minimizes accident risks from driver fatigue



### Fatigue Monitoring

Tracks eye and head movements to detect drowsiness



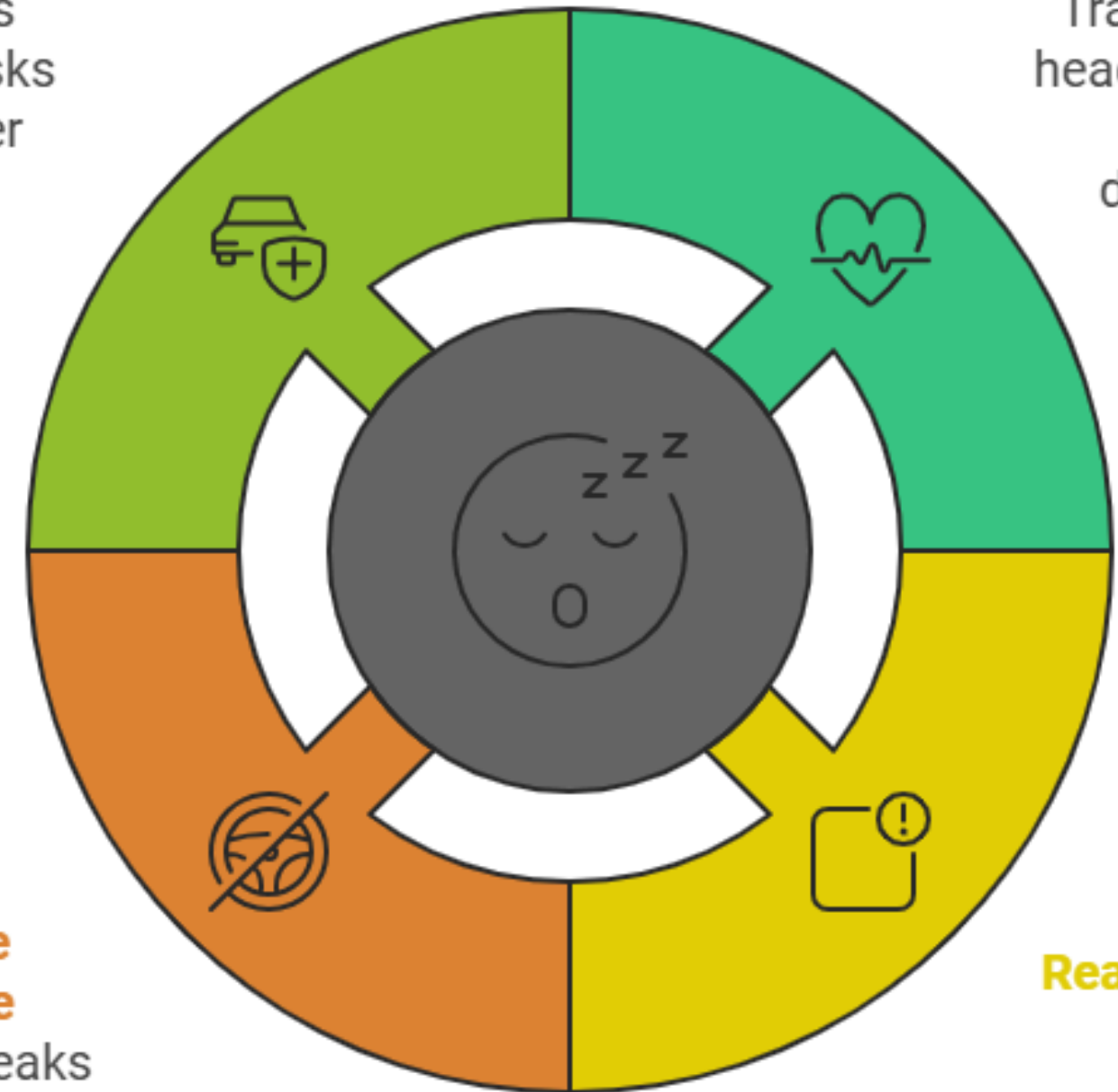
### Proactive Response

Suggests breaks and offers energizing options



### Real-Time Alerts

Provides immediate audio and visual warnings

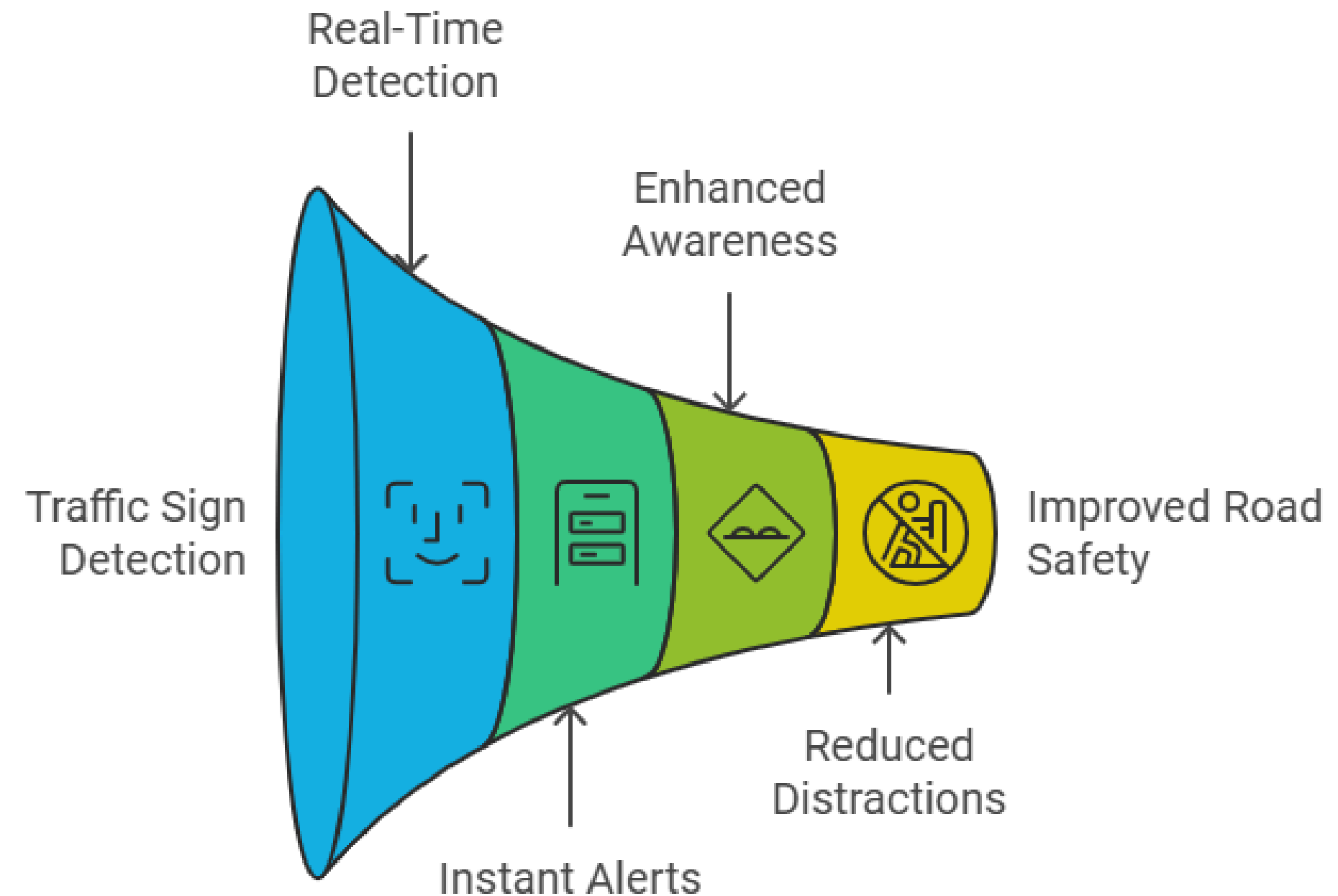


# ROAD SIGN DETECTION MODEL

Accuracy: 96%

- **Real-Time Detection:** Uses YOLOv5 to detect traffic signs like speed limits and stop signs.
- **Instant Alerts:** Displays real-time alerts for detected signs, ensuring compliance with road rules.
- **Enhanced Road Awareness:** Helps drivers respond appropriately to changing road conditions.
- **Reduced Distractions:** Minimizes the need for manual sign checking, keeping attention on the road.

Enhancing Driver Safety with AI



# PERFORMANCE AND SCALABILITY OVERVIEW

## **Code Efficiency:**

- ~3-4GB RAM, ~24GB disk space for training.
- Training on Colab TPU takes ~20-30 minutes for 10 epochs, with inference at ~5-10ms per file.

## **Accuracy & Precision:**

- Metrics like precision, recall, and SSIM/PSNR effectively measure performance.

## **Execution Speed:**

- Max latency of ~10 seconds during inference.

## **Robustness & Generalization:**

- Trained on a large dataset to handle diverse inputs effectively.

## **Innovativeness:**

- Combines innovative models to open new possibilities in automotive tech.

## **Scalability:**

- Model scales with increased computational resources for larger datasets.

# CONCLUSION

Our model integrates cutting-edge technologies to transform the driving experience, aligning with Qualcomm's vision of AI-driven automotive advancements, as highlighted in their [blog](#). With real-time object detection through YOLOv5 and personalized features such as speech authentication and navigation, we deliver enhanced safety, luxury, and convenience on the road.

## Expected Outcomes:

- **Safety Redefined:** Spot obstacles with precision and keep drivers alert when it matters most.
- **Personalized Driving Experience:** A car that adapts to your preferences, providing a tailored journey every time.
- **Real-World Reliability:** Engineered to handle complex driving scenarios with seamless performance.

## Future Enhancements:

- **Autonomous Driving:** Reinforcement learning will drive hands-free experiences, with dynamic decision-making.
- **Smart Headlight Adjustments:** Using YOLO models, headlights will automatically adjust based on traffic and road conditions.

With the integration of advanced sensors and further development, our model has the potential to evolve into a fully-fledged, autonomous driving system, setting the foundation for the future of smart automobiles.

*Thank  
You*